

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (Currently Amended): A method comprising:
 processing a stream of information-bearing symbols to form a plurality of symbol blocks,
wherein each symbol block comprises ~~one or~~ more than one of the information bearing symbols;
 generating multiple ultra-wideband (UWB) waveforms from the symbol blocks, wherein
each of the UWB waveforms convey the symbols of their respective symbol blocks as pulses
repeated over a plurality of frames; and
 transmitting the UWB waveforms over different antennas as a space-time coded UWB
communication.

Claim 2 (Currently Amended): ~~The method of claim 1,~~ A method comprising:
 processing a stream of information-bearing symbols to form a plurality of symbol blocks,
wherein each symbol block comprises one or more of the information bearing symbols;
 generating multiple ultra-wideband (UWB) waveforms from the symbol blocks, wherein
each of the UWB waveforms convey the symbols of their respective symbol blocks as pulses
repeated over a plurality of frames;
 transmitting the UWB waveforms over different antennas as a space-time coded UWB
communication,
 wherein processing a stream of information-bearing symbols comprises duplicating each
symbol to form a first symbol block and a second symbol block each comprising the same
information bearing symbol,
 wherein generating multiple UWB waveforms comprises generating a first UWB
waveform from the first symbol block and a second UWB waveform from the second symbol
block, and

wherein transmitting the UWB waveforms comprises simultaneously transmitting the first UWB waveform from a first transmit antenna and the second UWB waveform from a second transmit antenna.

Claim 3 (Original): The method of claim 1,

wherein processing a stream of information-bearing symbols comprises parsing the stream of symbols into blocks of symbol pairs,

wherein generating multiple UWB waveforms comprises generating a first UWB waveform to transmit the symbol pairs in a first order and a second UWB waveform to transmit the symbol pairs in a second order opposite from the first order, and

wherein transmitting the UWB waveforms comprises simultaneously transmitting the first UWB waveform from a first transmit antenna and the second UWB waveform from a second transmit antenna.

Claim 4 (Original): The method of claim 1, wherein processing a stream of information-bearing symbols comprises:

parsing the stream into a first block of symbols while maintaining an order of the stream of symbols; and

permuting the symbols of the first block to form a second block in which the symbols are in an order different from the order of the stream of symbols.

Claim 5 (Original): The method of claim 1, wherein generating multiple UWB waveforms power loading and pulse shaping each of the symbols of the symbol blocks to generate the pulses for transmission repeatedly over the plurality of frames.

Claim 6 (Original): The method of claim 1, wherein generating multiple UWB waveforms comprises applying pulse amplitude modulation.

Claim 7 (Original): The method of claim 1, wherein generating multiple UWB waveforms comprises applying pulse position modulation.

Claim 8 (Original): The method of claim 1, wherein generating multiple UWB waveforms comprises:

- permuting the frames to interleave the frames; and
- generating multiple UWB waveforms from the interleaved frames.

Claim 9 (Original): The method of claim 1, further comprising:

- receiving the transmitted UWB waveforms through a wireless communication channel with a plurality of receive antennas; and

- performing maximum ratio combining (MRC) on the plurality of frames to produce a stream of estimate symbols.

Claim 10 (Original): The method of claim 9, wherein receiving the transmitted UWB waveforms comprises:

- receiving a first UWB waveform of the transmit signals with a receive antenna;

- receiving a second UWB waveform of the transmit signals with the receive antenna, and

wherein performing MRC comprises:

- performing maximum ratio combining (MRC) on the first UWB waveform to yield a first decision statistic;

- performing MRC on the second UWB waveform to yield a second decision statistic;

- combining the first and second decision statistics to create a combined decision statistic;

and

- outputting an estimate symbol based on the combined decision statistic.

Claim 11 (Original): The method of claim 9, further comprising separating the received UWB waveforms into even and odd indexed frames at the receive antennas.

Claim 12 (Currently Amended): A wireless communication device comprising:

- a space-time (ST) encoder that processes a stream of information-bearing symbols to form a plurality of ST-encoded symbol blocks, wherein each symbol block comprises ~~one or~~ more than one of the information bearing symbols;

a plurality of pulse shapers that generate multiple ultra-wideband (UWB) waveforms from the symbol blocks, wherein each of the UWB waveforms convey the symbols of their respective symbol blocks as pulses repeated over a plurality of frames; and

a plurality of antennas that transmit the UWB waveforms over a wireless communication channel.

Claim 13 (Currently Amended): ~~The wireless communication device of claim 12,~~ A wireless communication device comprising:

a space-time (ST) encoder that processes a stream of information-bearing symbols to form a plurality of ST-encoded symbol blocks, wherein each symbol block comprises one or more of the information bearing symbols;

a plurality of pulse shapers that generate multiple ultra-wideband (UWB) waveforms from the symbol blocks, wherein each of the UWB waveforms convey the symbols of their respective symbol blocks as pulses repeated over a plurality of frames;

a plurality of antennas that transmit the UWB waveforms over a wireless communication channel, wherein the ST encoder duplicates each symbol to form a first symbol block and a second symbol block each comprising the same information bearing symbol, and the plurality of pulse generators generate a first UWB waveform from the first symbol block and a second UWB signal from the second symbol block for simultaneous transmission via the plurality of antennas.

Claim 14 (Original): The wireless communication device of claim 12, wherein the ST encoder parses the stream of symbols into blocks of symbol pairs and, for each symbol pair, generates a first symbol block that stores the pair of symbols in a first order and a second symbol block that duplicates the pair of symbols and stores the pair of symbols in a second order opposite from the first order.

Claim 15 (Original): The wireless communication device of claim 12, further comprising a frame interleaver that permutes the frames to interleave the frames.

Claim 16 (Original): The wireless communication device of claim 12, wherein the pulse shapers modulate the pulses for transmission repeatedly over the frames.

Claim 17 (Original): The wireless communication device of claim 12, wherein the pulse shapers apply pulse amplitude modulation to the pulses.

Claim 18 (Original): The wireless communication device of claim 12, wherein the pulse shapers apply pulse position modulation.

Claim 19 (Original): The wireless communication device of claim 12, wherein the wireless communication device comprises one of a base station and a mobile device.

Claim 20 (Currently Amended): A wireless communication device comprising:
a plurality of antennas to receive a plurality of space-time (ST) encoded ultra wideband (UWB) waveforms through a wireless communication channel, each ST encoded UWB waveform having a plurality of information-bearing symbols within a symbol block that are conveyed as pulses repeated over a plurality of frames; and
a maximum ratio combining (MRC) unit that processes the ST encoded UWB signals and produces a stream of estimate symbols.

Claim 21 (Original): The wireless communication device of claim 20, wherein the received UWB waveforms are separated into even and odd indexed frames at the receive antennas.

Claim 22 (Original): The wireless communication device of claim 20,
wherein the plurality of antennas comprise a first antenna that receives a first UWB waveform and a second antenna that receives a second UWB waveform, and
wherein the MRC unit:
performs maximum ratio combining (MRC) on the first UWB waveform to yield a first decision statistic,
performs MRC on the second UWB waveform to yield a second decision statistic,
combines the first and second decision statistics to create a combined decision statistic,
and
outputs one of the estimate symbols based on the combined decision statistic.

Claim 23 (Original): The wireless communication device of claim 20, wherein the wireless communication device comprises one of a base station and a mobile device.

Claim 24 (Currently Amended): An ultra-wideband communication system comprising:
a transmitter that outputs a plurality of space-time (ST) encoded ultra wideband (UWB) waveforms via a plurality transmit antennas, each ST encoded UWB waveform having a plurality of information-bearing symbols within a symbol block that are conveyed as pulses repeated over a plurality of frames; and
a receiver that receives the plurality of ST-encoded UWB waveforms via a wireless communication channel, and performs maximum ratio combining (MRC) on the UWB signals to produce estimate symbols.

Claim 25 (Original): The ultra-wideband communication system of claim 24, wherein the receiver comprises a plurality of receive antennas to receive the UWB waveforms.

Claim 26 (Original): The ultra-wideband communication system of claim 25, wherein the received UWB waveforms are separated into even and odd indexed frames at the receive antennas.

Claim 27 (New): The wireless communication device of claim 12, wherein the ST encoder parses the stream into a first block of symbols while maintaining an order of the stream of symbols, and permutes the symbols of the first block to form a second block in which the symbols are in an order different from the order of the stream of symbols.